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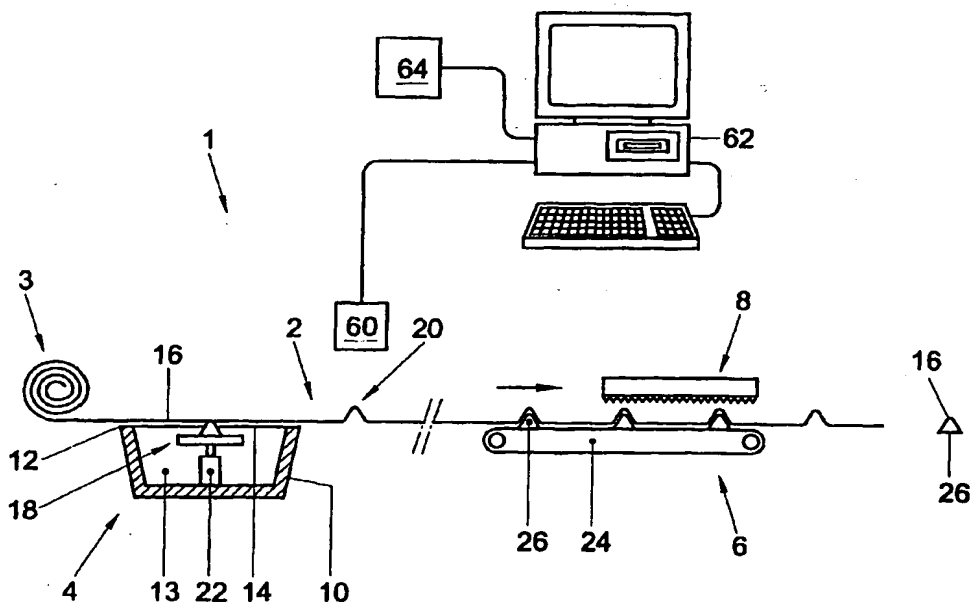

(57) Abstract: A method for decorating products (26), wherein a product (26) is manufactured from plastic and at least a part of the product is covered by a foil (16), on which foil a desired decoration (38) is provided prior to bonding thereof to the product (26), wherein the foil prior to bonding thereof to the product is deformed with the aid of a preform (18).

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Title: Method and apparatus for decorating products.

This invention relates to a method for decorating products. The invention relates in particular to a method for decorating at least one at least partly double-curved, at least three-dimensionally defined face of a plastic product.

Decoration should herein be understood to mean at least both providing patterns in different colors or shades and coloring surfaces in one or more colors.

It is known to provide products with a decoration by spraying the products, after manufacture, in a desired color or with a desired pattern, where the provision of a pattern necessitates the same number of spraying passes as the number of colors used. Such a method is relatively easy to carry out but is relatively labor-intensive, especially when several spraying passes are necessary. Moreover, such a method leads to products having a less pleasing appearance. Especially in the case of multiple-curved surfaces, differences in coverage, coloring and the like will occur as a result of variations in distance between the spray nozzle and the surface, while moreover drips can occur relatively readily. Further, relatively much lacquer is lost, which is environmentally undesirable. A further drawback of this known method is the drying time, which results in a relatively long overall time of passage. Also, it is difficult to apply spray masks specifically to double-curved surfaces, as a result of which patterns substantially cannot be applied sufficiently reproducibly.

Furthermore, products which are to have a plain color are colored by addition of a dye to the material from which the products are formed, or the products are dipped in a color bath. It will be clear that in this way only substantially plain-colored products can be obtained, while the dipping method moreover often leads to the same disadvantages as spraying the products.

Furthermore, it has been proposed to provide parts of products with adhesive film with printing, for instance lettering. Such a method is only applicable to relatively flat parts of products, while moreover adhesive film leads to a less pleasing appearance.

The invention contemplates a method of the type described in the opening paragraph hereof, in which the above-mentioned drawbacks of the known methods have been avoided, while maintaining the advantages thereof. To that end, a method according to the invention is characterized by the features of claim 1.

In a method according to the invention, a decoration is provided on a foil prior to bonding the foil to a relevant part of the product. The foil, moreover, prior to being bonded to the product, is deformed with the aid of a preform, such that the foil at least partly obtains the shape corresponding to a surface of the product to which the foil is to be bonded. Only after that is a fixed bond of the foil to the product effected. With such a method, any desired decoration of the product can be obtained, both plain, at least monochrome, as well as in a variety of preselected patterns in one or more colors and/or shades. Use of a foil according to the invention moreover provides the advantage that the product obtains a particularly pleasing appearance, while spraying mists and the like are avoided. In this way, a finish of a particularly high-grade quality is obtained. The foil can be simply made of mat or glossy design and leads to a particularly pleasing appearance. Moreover, for each product the appearance can be individually determined by the use of a foil with a product-specific printing.

According to the invention, the foil is preferably provided with a printing while in substantially flat condition, prior to deformation of the foil. As a consequence, any desired printing technique is applicable. The deformation of the foil is preferably three-dimensional, at least matching a double-curved surface, and preferably occurs through stretching of the foil in at least two directions extending approximately at right angles to each

other. As preform for deforming the film, the product or a portion thereof can be used, but it is often preferred that an element is used which, as to shape, corresponds at least largely, but not completely so, to the product or a portion thereof to be decorated. The same preform can then be reused every time, while during bonding of the foil to the product, a slight further stretching occurs, so that a particularly taut bond is obtained.

In a first advantageous embodiment, a method according to the invention is further characterized by the features of claim 6.

In such a method, products, at least parts thereof, are formed, for instance through injection molding, deep-drawing, pressing or the like, whereafter the foil, preformed separately therefrom, is arranged over the respective products or parts thereof and is heated such that the foil is fixedly bonded to the product. This affords a relatively great freedom of design, while different techniques can be used for the manufacture of the product.

In an alternative embodiment, a method according to the invention is characterized by the features of claim 7.

In such a method, the deformed foil, at least the deformed part thereof, is placed in or near a mold cavity of an injection mold, whereafter plastic is introduced into the mold cavity for forming the desired product or portions thereof. In the mold cavity, adhesion will occur between the foil and the respective plastic, so that a fixed bond is obtained. Thus, a decorated product, or portion thereof, can be obtained in a particularly simple manner.

It is preferred that in a method according to the invention the foil, while being jointed to the product, is stretched out slightly further. As a result, a complete fit between the foil and the product is obtained, while moreover creasing and the like are simply prevented.

The foil can be supplied in sheets but it is preferred that the foil be supplied in the form of a web and a series of deformations are provided in the web. This enables a continuous production process even more readily.

In a further advantageous embodiment, a method according to the invention is furthermore characterized by the features of claim 13.

In such a method, the decoration is provided in such a manner that, when the foil has been completely deformed, that is, in the condition where the foil has been applied fittingly on the respective product, the decoration has the desired appearance. The decoration will, for instance, be pressed on the flat foil, such that after the deformation of the foil through elongation in the different directions, the decoration on the product at least in plan view has the desired appearance. The printing will therefore be more compressed in the flat plane than after deformation. Preferably, an appropriate algorithm is used to compute in advance, on the basis of the elongations to be expected, the nature and extent of deformation of the foil, the necessary deformation of the decoration to be applied and, on the basis thereof, to control a printing device.

In further elaboration, a method according to the invention is furthermore characterized by the features of claim 15.

The use of recognition means as part of the printing provides the advantage that with the aid of reading means, for instance pattern recognition means, it can be simply determined whether the desired decoration has been obtained on the product formed. Specifically on the basis of the relative position of the recognition elements it can then be established, with the aid of the reading means, whether any deviations have remained within desired margins, and there can be feed-back to the computing unit, so that the deformation of the decoration preceding deformation of the foil can be adapted. Thus, a self-regulating system can be obtained, readily enabling, for instance, small variations in properties of the foil to be overcome.

In a further advantageous embodiment, a method according to the invention is furthermore characterized by the features of claim 18.

With such a method, deformations can be provided in a foil in a simple manner, without necessitating relatively complex retaining means for keeping the foil taut during deformation thereof. In a surprising manner, use is made of partial vacuum and adhesion and cohesion between foil and liquid, with the liquid performing the function of a stripper plate.

The invention further relates to an apparatus for decorating products, characterized by the features of claim 21 or 22. Such an apparatus is suitable in particular for practicing a method according to the invention.

The invention additionally relates to a product, characterized by the features of claim 25.

Such a product, which can be simply manufactured with a method and apparatus according to the invention, has a particularly pleasing appearance, while moreover variations in that appearance can be provided particularly simply.

To clarify the invention, exemplary embodiments of a method, apparatus and product according to the invention will be further elucidated with reference to the drawing. In the drawing:

Fig. 1 schematically shows a decorating apparatus according to the invention, in a first embodiment;

Fig. 2 schematically shows a decorating apparatus according to the invention, in a second embodiment;

Fig. 2a shows on an enlarged scale a portion of a deforming apparatus according to the invention;

Figs. 3 and 4 show, in top plan view, two portions of foil webs with printing, before and after deformation;

Fig. 5a schematically shows in side elevation an injection mold with deformed foil web;

Fig. 5b shows in cross section a product formed with a mold according to Fig. 5a, directly after demolding;

Fig. 5c shows a product according to Fig. 5b, with cut-off edges;

Fig. 6 shows a foil web in top plan view, in undeformed condition (right) and in deformed condition (left);

Fig. 7 shows a foil web in top plan view, in undeformed condition (right) and deformed condition (left), with priorly deformed decoration;

Fig. 8 schematically shows deforming means combines with an injection mold for use in a method according to the invention; and

Fig. 9 shows a computer mouse with a decoration provided in accordance with the invention.

In this description, the same or corresponding parts have the same or corresponding reference numerals. The exemplary embodiments shown are given merely by way of illustration and should not be taken to be limitative in any way.

Fig. 1 schematically shows a decorating apparatus 1 according to the invention, in a first exemplary embodiment. A foil web 2 is supplied from a roll 3, successively along deforming means 4, positioning means 6 and heating means 8. The deforming apparatus 4 comprises a receptacle 10 with a liquid therein, for instance water. The receptacle 10 is filled up to the upper longitudinal edge 12. The foil web 2 is disposed on the liquid surface 14 and the longitudinal edges 12, such that the receptacle 10 is covered entirely and the foil 16 is in full contact with the liquid 13. Set up in the receptacle 10 is a preform 18 which is movable between a lower position, as shown in Fig. 1, and an upper position, as basically shown in Fig. 2a. In the upper position, the preform 18 extends at least partly above the liquid surface 14, thereby deforming the foil 16 at that point. As a result of the full contact of the foil 16 with the liquid surface 14, the foil 16 is retained by the liquid 13, while the foil 16 is deformed at that point by the preform 18 by stretching of the foil in different directions. As a result, the foil 16 will follow the preform 18 with a close fit, with the liquid 13 in fact functioning as stripper plate. After withdrawal of the preform 18 back into the receptacle 10, the deformation 20 remains behind in the foil web 20, at least

substantially so. In the embodiment shown, the preform 18 is supported by a cylinder-piston assembly 22 for the displacement thereof. It will be clear, however, that other known movement means can also be used for that purpose, for instance a lever or the like. In this embodiment, the preform 18 is pressed against the foil 16 from the underside, that is, from the side proximal to the liquid 13. It is also possible, however, to press a comparable preform against the foil 16 from the opposite side, whereby the deformation 20 will be formed downwards, into the liquid 13. Also, deforming means cooperating on opposite sides of the foil web 2 may be used.

After providing the desired deformation and withdrawing the preform 18, the foil web 2 is transported further in the direction T, to positioning means 6, which, in the embodiment shown, comprise a conveyor belt 24 on which product parts 26 to be decorated have been placed, preferably in uniformly spaced apart relation, corresponding to the distance between two successive deformations 20. The foil web 2 is positioned over the conveyor belt and the product parts 26 disposed thereon, such that in each case a deformation 20 overlies a product part 26. Next, the foil web with the thus covered product parts 26 is transported further, to a point under the heating means 8, for instance a radiation heater, with which the foil 16 and the product parts 26 are heated such that, as a result of the heat, these are fixedly bonded to each other. Product part 26 and foil 16 cannot subsequently be separated from each other anymore without damage. Next, the foil web 2 with the product parts 26 fixedly included therein is transported further, outside the heating means 8, whereafter the thus formed product part 26 with foil 16 can be cut loose from the foil web 2 and can be finished further, for instance by cutting off excess foil material or removing this by die-cutting. The thus formed product part 26 is provided with a foil on which a printing has been provided which can have any desired shape. This will be further discussed hereinafter. The product part

26 can be a finished product but may also be a component of a product yet to be assembled.

Fig. 2 shows an alternative embodiment of a decoration apparatus 1 according to the invention, in which the deforming means 4 are designed as described in Fig. 1. In this embodiment, the foil web 2 with the deformations 20 is guided between two mold halves 28, 30 of an injection mold 32, such that a deformation 20 is received in a mold cavity 34 of the mold part 28. Next, the mold 32 is closed, whereafter plastic is introduced into the mold cavity 34 with the aid of supply means 36, known per se. During filling of the mold cavity 34, the foil 16, at least the deformed part 20 thereof, will, due to the supplied plastic and the pressure and temperature increase in the mold cavity 34, be fixedly bonded to the plastic to form one whole, as shown in Fig. 2 on the right-hand side, where two products 26 are shown, on the left with foil edges 16, and on the right with the foil edges 16 cut off. In this product 26, the upwardly directed, double-curved surface 37 is provided with a printing 38, as will be further elucidated hereinbelow.

As described earlier, the foil 15 is stretched out in the deforming apparatus 4. In deforming for use on a double-curved surface, elongation in the foil will occur in different directions. A printing 38 provided on a foil web 2 will therefore be stretched out in different directions. Figs. 3 and 4 show two embodiments thereof. In Fig. 3, at the bottom, a first printing 38A is shown, in flat condition, directly after printing. This printing can be applied to the foil 16, for instance, with an ink suitable for the purpose and a printer, screen-printing device or other suitable printing device. The printing 38A and the subjacent foil 16 are flat there. In Fig. 3 at the top, a second printing 38B is shown, during or after deformation of the foil web 2. Shown around the printing 38B is the contour of the deformation 20. As appears clearly from a comparison between the first printing 38A and the second printing 38B, the printing 38 is stretched on all sides during deformation, so that the printing (a flower in the embodiment shown) is

enlarged and can change slightly in shape, depending on the extent and nature of deformation. Fig. 4 shows a comparable deformation, but with a check pattern provided as printing 38. In Fig. 4 at the bottom, the undeformed printing 38A is shown, with rectangular checks. In Fig. 4 at the top, a slightly convex deformation 20 is shown, having a slightly oval contour 21. This clearly shows that the printing 38B originally applied as rectangular checks has been deformed, with the deformations adjacent the contour 21 being less strong than those adjacent the center. With such deformations 20 with printings 38, products or product parts having a pleasing appearance can be manufactured.

With a method according to the present invention, it is also possible to process foils 16 that are of plain and/or monochrome design, with which products 26, or at least parts thereof, can be uniformly colored. Thus, for instance, products can also be provided with a metal or metal-colored covering layer, for instance by the use of a foil with a chrome finish. Specifically in such an application, a method according to the present invention is also advantageous in that it enables products to be provided with a metal appearance, for instance chromed, at least provided with a chromed appearance, without entailing the known disadvantages of chrome-plating products, such as undesired environmental pollution, manufacture of special, product-related chrome-plating racks and the like. A specific manner of manufacturing printings 38 for foil according to the invention will be discussed hereinafter with reference to Figs. 6 and 7.

Fig. 5a schematically shows, enlarged, a mold 32 for use according to the invention, having therein a foil 16 with deformation 20. In this embodiment, the deformation 20 is slightly dented at a central part 21, while the deformation 20 is less strong than is necessary for the deformation 20 to abut against the inside of the mold cavity 34 formed in the upper mold part 28. The deformation 20 is, for instance, between 60 and 95%, more particularly between 70 and 85% of the deformation needed for the

abutment mentioned. During filling of the mold cavity 34, therefore, the foil 16, in particular the part thereof that constitutes the deformation 20, will be stretched still further, as a result of the filling pressure and possibly after-pressure of the plastic to be introduced into the mold cavity. As a result, a particularly good coverage of the product 26 by the foil 16 is obtained, creasing is prevented, and damage to the foil 16 is prevented still better, notably also as a consequence of the stronger deformation adjacent the central part, opposite the feed-in opening 35 for the plastic. In a method according to the invention, it will always be easy to determine the suitable extent and nature of deformation of the foil, depending inter alia on the foil used. It is then preferred that a foil having a particularly homogeneous structure is used, whose elongation in any direction is reproducible in a particularly high degree. This is specifically relevant when products are manufactured with a printing in the form of one or more patterns, for instance as shown in Figs. 3, 4, 6 and 7, which is to be applied consistently in the same manner on series of products. In order to further enhance such reproducibility, use can be made of a printing which is deformed with respect to the desired end result as printing on a product, such that this printing, precisely by said deformation of the foil, is brought into the desired eventual form. This will be elucidated with reference to Figs. 6 and 7 and is comparable to anamorphoses.

In Fig. 6, on the right-hand side, a foil web 2 is shown, provided with a printing 38 in the form of a check pattern as shown and described with reference to Fig. 4. The checks 39 are formed by lines 40 extending at right angles to each other. As preform 18, from the underside, a sphere is pressed into the foil web 2, such that a deformation 20 of the foil web 2 occurs as shown in Fig. 6 on the left-hand side. The foil 16 on the preform 18 has thereby been stretched, so that the initially parallel lines 40 will no longer extend parallel to each other on the deformation 20, neither in the longitudinal direction of the foil web nor at right angles thereto. Apart from

any lines that intersect the deformation exactly in the center, the lines 40 on the deformation 20 exhibit curvatures. In some applications, this will be permissible or even desired, for instance in the case of plain foils or foils already having inherent irregular printings, such as wood grain, spatter patterns or like relatively random printings. In this way, even serially individualized products can be manufactured, specifically in the case of inhomogeneously deformed foils. In other applications, however, this will be undesired, for instance in the case of printings comprising lettering, specific geometric or other shapes or the like. To provide these on a surface in a desired manner with a method according to the invention, a deformation as shown in Fig. 7 can be used.

In Fig. 7, on the right-hand side, a flat foil web 2 is shown, having thereon a printing 38 in the form of a slightly oval contour 21, having inside of it a pattern of lines 40a, 40b. The first series of lines 40a has a main direction extending substantially in the longitudinal direction of the foil web 2, while the second series of lines 40b extends substantially transversely thereto. The lines 40a, 40b that extend through the center C of deformation are approximately straight in the exemplary embodiment shown, while the other lines 40a, b are curved, with a convex side facing the center C. The curvature of the lines 40a, b located closer to the contour 21 is less than that of the lines 40a, 40b located closer to the center C. This pattern of lines 40a, 40b has been computed with the aid of a computing unit with a suitable algorithm, on the basis of inter alia the stretch behavior of the foil 16 and the desired nature and extent of deformation thereof, in such a manner that given the complete deformation 20, the printing 38, in top plan view, that is, at right angles to the plane of the foil web 2, yields an appearance as shown in Fig. 7 on the left-hand side. In this view, the lines 40a, 40b extend at right angles to each other, with the lines 40a extending parallel to the longitudinal direction of the foil web 2, and the second lines 40b at right angles thereto. In this embodiment, the effect contemplated has been shown

with reference to a line pattern. It will be clear, however, that in the same manner, any printing can be provided in a pre-computed deformed condition in order to obtain the desired appearance on a double-curved surface. Notably, this can also be done with a printing which comprises, for instance, lettering. Algorithms that can be used for this purpose are included, for instance, in 3D CAD programs for graphic or technical applications, suitable making developed drawings.

In Figs. 1 and 2, after the deforming means 4, reading means 60 are set up, coupled to a computing unit 62 and arranged for pattern recognition. With these, the deformation 20 is viewed and it is determined if it has the correct form. To that end, recognition means on the foil, as part of the printing, are used, for instance two or more intersections 40C of lines 40a, 40b in Fig. 7. The deformation can be read from the relative position of such intersections 40C. In Fig. 1 the reading means 60 are arranged directly after the deforming means 4. As a consequence, with the aid of the computing unit 62, adjustment can be effected relatively fast, through adaptation of the printing and/or the deformation. However, this can be done only on the basis of the deformation 20, not on the basis of the product (part) 26, which is disadvantageous especially when subsequently further deformation occurs, or the deformation "collapses" for lack of stiffness. In Fig. 2 the reading means are set up after the injection mold 32. Accordingly, the printing is viewed in its eventual form and on the basis thereof the printing, in particular the deformation thereof, can be adapted with the aid of the computing unit. Also, naturally, the extent of deformation 20 can be adjusted. In this way, also irregularities in the stretching behavior of the foil 16 can be compensated.

Fig. 8 schematically shows an apparatus 40 for application within a method according to the invention, where deforming means 4 cooperate with a mold 32 as described earlier, at least with the upper part 28 thereof. In this embodiment, the upper mold part 28 is provided, around the mold

cavity 34, in the land face 33, with vacuum cavities 42 connected via ducts 44 with a vacuum pump 46, represented schematically. A foil web 2 can be secured against the land face 33 with the aid of the vacuum cavities 42, in flat condition. Next, a deforming means 4 is pressed against the side of the foil web 2 remote from the mold cavity 34, thereby creating a deformation 20 as described earlier. To that end, the deforming apparatus 4 comprises a block 48 with a preform 18 thereon. The block 48 is preferably designed such that it includes a land face 83a which can cooperate with the land face 33 of the upper mold half 28. In this manner, during deformation, the foil web 2 is retained still better.

Optionally, the preform 18 can be movable relative to the block 48, so that the block 48 can clamp the foil first, prior to the deformation with the preform 18.

After the desired deformation 20 has been provided in the foil 16, within the mold cavity 34, the deforming apparatus 4 is removed and replaced with a lower mold half 30, as described earlier. The lower mold half 30 can optionally comprise cutting means 52, with which the deformation 20 can be cut loose along the longitudinal edge of the mold cavity 34. However, this can also be effected later, after taking out the product 26. After the mold 32 has been closed, plastic under a relatively high pressure and heat is charged to the cavity 34 via the supply means 36, for forming the product 26, thereby possibly stretching the foil 16, at least the deformation 20, further as far as the wall of the mold cavity 34. As a result of the pressure and heat, again a fixed bond between plastic and foil is obtained.

Fig. 9 schematically shows a computer mouse 54, provided with a double-curved face 37 with printing 38, applied with a method according to the invention. This printing 38 extends over the entire upper part 56 of the mouse 54 and comprises a substantially even portion 38A and a lettering 38B which follows at least partly a contour and profiling of the mouse 54. The lettering 38B is provided, deformed, on a flat foil 2, such that after

deformation of the foil and bonding same to the double-curved surface 37 the lettering 38B is properly legible and has been brought into the desired position and shape. It will be clear that this mouse 54 is only an example of a product formed with a method and apparatus according to the invention, shown here merely by way of illustration. Parts of letters can serve as recognition means for the reading means 60.

By the use of a method according to the invention, products can be obtained having seamless foil coverings on double-curved surfaces. Moreover, foils can be used having a variety of properties, in particular barrier properties, for instance suitable for foods, resistant to chemicals, liquids, acids and bases, and the like, low or high temperatures or other ambient influences, or provided with reflective properties or for high-grade finishing of the product.

With the foil, other elements can be added to the product as well, for instance graphic elements such as holograms, electric or electronic components such as chips, conductive tracks, or, conversely, insulation, harder or softer surface parts and the like.

The invention is not limited in any way to the exemplary embodiments shown and described in the description. Many variations thereon are possible within the framework of the invention outlined by the claims.

Thus, deformations in a foil web can be provided in a different suitable manner, for instance through the use of a mold and countermold, between which the foil is clamped, optionally utilizing temperature elevation, vacuum means as in vacuum forming techniques or the like. With a method according to the present invention, both single- and double-curved surfaces can be finished. In the exemplary embodiments shown, the plastic is applied against the foil 16 from the back, that is, on the side remote from the printing. However, it is also possible to use foils with printings that are sufficiently heat-resistant, such that the printings are locked between the

plastic and the foil. Used for this purpose are transparent or opaque types of foil. It will be clear, naturally, that both closed foils and apertured foils can be used, monolayer as well as multilayer. Also, with a method according to the present invention, two or more foil layers can be applied one over the other, for instance to protect the printing. With a method according to the present invention, both uniform, identically printed products and varying products can be manufactured. In principle, with the aid of a printing apparatus controlled by the computing unit, for each product individually, a printing can be applied to the foil web, to be subsequently attached to the respective product or product part. This affords particularly great freedom in design. The computing unit can be controlled on-line, for printing on demand. In a method as described with reference to Fig. 1, the products or parts thereof can be manufactured in any suitable manner, for instance through injection molding, deep-drawing, vacuum forming, material-removing operations, combinations thereof and the like. Also, inserts can be placed in a mold cavity in the practice of a method according to the present invention.

These and many comparable variations are understood to fall within the scope of the invention outlined by the claims.

CLAIMS

1. A method for decorating products (26), wherein a product (26) is manufactured from plastic and at least a part of the product (26) is covered by a foil (16), on which foil (16) a desired decoration (38) is provided prior to bonding thereof to the product (26), wherein the foil (16) prior to bonding thereof to the product is deformed (20) with the aid of a preform (18).

2. A method according to claim 1, wherein the decoration (38) is provided as a printing on the foil (16) prior to the deformation (20) of the foil (16).

3. A method according to claim 1 or 2, wherein the deformation (20) of the foil (16) is three-dimensional and occurs through stretching of the foil (16) in at least two directions.

4. A method according to any one of the preceding claims, wherein as preform (18) an element is used which in shape corresponds at least largely to the product (26), or portion thereof, to be decorated.

5. A method according to any one of claims 1 to 3, wherein as preform (18) the product (26) or a portion thereof to be decorated is used.

6. A method according to any one of the preceding claims, wherein the deformed foil (16) is provided over a respective surface (37) of the product (26) and is heated, together with the product (26), at least the respective portion thereof, such that an adhesion between the foil (16) and the respective product (26), at least portion thereof, is obtained.

7. A method according to any one of claims 1 to 5, wherein the deformed foil (16) is placed in a mold cavity (34) of an injection mold (32), whereafter plastic is introduced into the mold cavity (34), for forming the desired product (26) or portion thereof, such that the foil (16) is bonded with the plastic.

8. A method according to claim 6 or 7, wherein the foil (16), during bonding thereof to the product (26) or portion thereof, is stretched further.

9. A method according to claim 7 or 8, wherein the foil is stretched further by the filling pressure in the mold cavity (34).

10. A method according to any one of the preceding claims, wherein the foil (16) is supplied in a web (2) and a series of deformations (20) are provided in the web (2), and wherein the deformations (20) are subsequently bonded to the relevant parts of the products (26).

11. A method according to any one of claims 1 to 6 and 10, wherein the web (2) of foil (16) with the deformations (20) is laid over a series of products (26), at least relevant parts thereof, the web (2) along with the products (26), at least parts thereof, is subsequently heated by heating means (8), such that the desired bond between the foil (16) and the relevant product parts (26) is obtained, whereafter the products (26), at least the relevant parts thereof, are cut out from the web (2).

12. A method according to claims 7 and 10, wherein in each case a deformation (20) of the foil web (2) is placed in a mold cavity (34), at which time, or thereafter, the deformation (20) is cut out from the foil web (2) prior to or during closure of the mold (32) in which the mold cavity (34) is included.

13. A method according to any one of the preceding claims, wherein the decoration (38) is provided while deformed, and the deformation (38) is chosen such that when the foil (16) in deformed condition is bonded to the product (26), at least the relevant part thereof, the decoration (38) has the desired appearance.

14. A method according to claim 13, wherein the extent and nature of the deformation of the foil (16) is determined and is inputted into a computing unit (62), which computing unit (62) comprises an algorithm for determining, on the basis of said deformation and at least the deforming properties of the foil (16) to be used, the necessary deformation of the decoration (38) to be provided, while the desired, deformed decoration (38) is provided on the foil (16) with the aid of a printing apparatus (64).

15. A method according to claim 13 or 14, wherein with the decoration (38) recognition elements (40C) are provided, while reading means (60) are provided for recognizing the recognition elements (40C), preferably after the foil (16) has been bonded to the product (26), at least the relevant part thereof, the algorithm being arranged for adapting the necessary deformation of the decoration (38) to be provided on the foil (16) when undesired deviations of the position of the recognition elements (40C) are established with the aid of the reading means (60), in particular deviations in the relative position of a number of said recognition elements (40C).

16. A method according to any one of the preceding claims, wherein as foil (16) a plastic foil is used having relatively constant stretch properties in at least two directions at right angles to each other.

17. A method according to claim 16, wherein the stretch properties of the foil (16) are selected such that the deformations in the foil (16) are reproducible.

18. A method according to any one of the preceding claims, wherein the foil (16) is placed on a liquid surface (14), such that at least a portion of the foil (16) lies flat on the liquid surface (14) and is in contact therewith, whereafter the preform (18) is pressed against the foil (16), such that the foil (16) is deformed by the preform (18) while the part of the foil (16) that surrounds the preform (18) is retained by contact forces with the liquid (13), whereafter the foil (16) is taken off the liquid surface (14) for further processing.

19. A method according to claim 18, wherein the preform (18) is taken out of, at least away from, the deformed part (20) of the foil (16) prior to removing the foil (16).

20. A method according to claim 18 or 19, wherein the preform (18) is pressed against the foil (16) from the side proximal to the liquid surface (14).

21. An apparatus 1 for decorating products (26), comprising:

deforming means (4) for deforming foil (16) with a preform (18);

- supply means (6) for supplying preformed products (26) or product parts;
- positioning means for positioning foil (16) deformed with the deforming means, with respect to the products (26) or product parts, such that the deformed foil (16) can be placed in a fitting manner over the products (26) or product parts; and
- heating means (8) for bonding the deformed foil (16) to a product or product part.

22. An apparatus 1 for decorating products (26), comprising:
- deforming means (4) for deforming foil (16) with a preform (18);
- a mold (32) with at least one mold cavity (34) for forming products (26) or product parts;
- means for positioning foil (16) deformed with the deforming means, in, at least near, the mold cavity (34) in opened condition; and
- means (36) for applying plastic, in the mold cavity (34) in closed condition, against the foil (16), such that the deformed part (20) of the foil (16) is pressed against a wall of the mold cavity (34) or a part of a product (26) received or formed therein, while the plastic adheres to the foil (16) for obtaining a desired bond therewith.

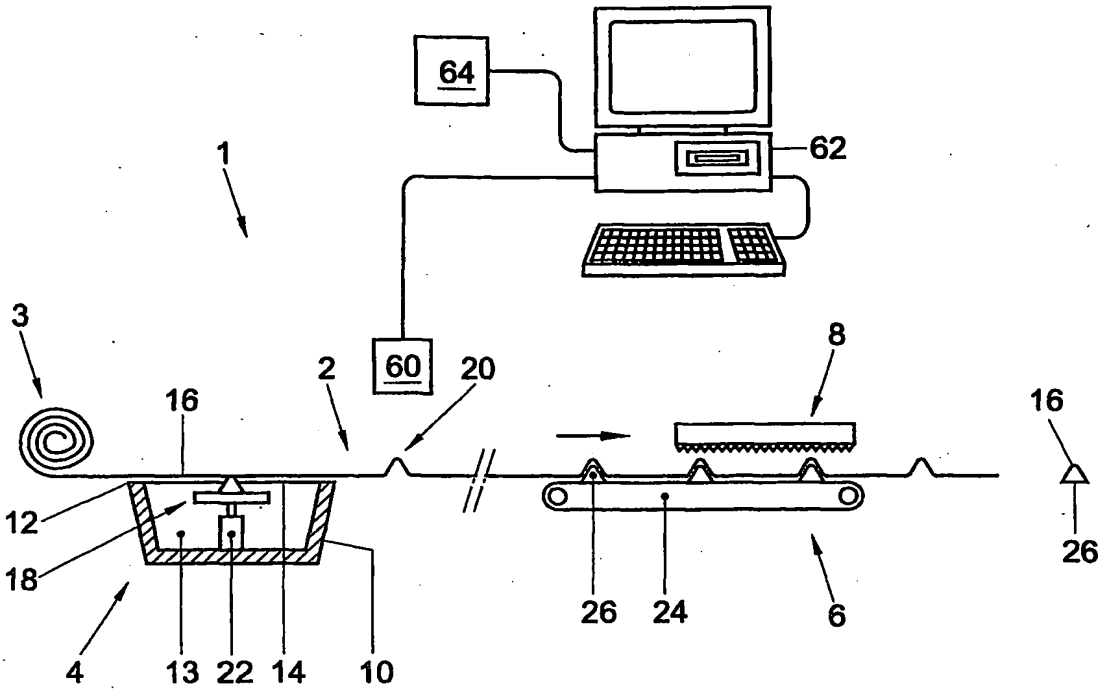
23. An apparatus according to claim 21 or 22, wherein printing means (64) are provided for providing a printing (38) on the foil (16).

24. An apparatus according to claim 23, wherein a computing unit (62) with an algorithm is provided for controlling the printing means (64), the algorithm being arranged for determining, on the basis of at least the stretch properties of the foil (16) and the nature and extent of deformation of the foil (16) desired for decoration of the respective product (26) to be decorated, a desired deformation of the decoration (38) to be printed.

25. A product 26 with at least one double-curved surface (37), provided with a foil (16) fixedly bonded thereto, while the foil (16) is provided with a printing (38).

26. A product according to claim 25, wherein the printing (38) is figurative and comprises at least two different colors, in a preselected pattern.

27. A product according to claim 25, wherein the printing (38) is at least substantially monochrome.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26
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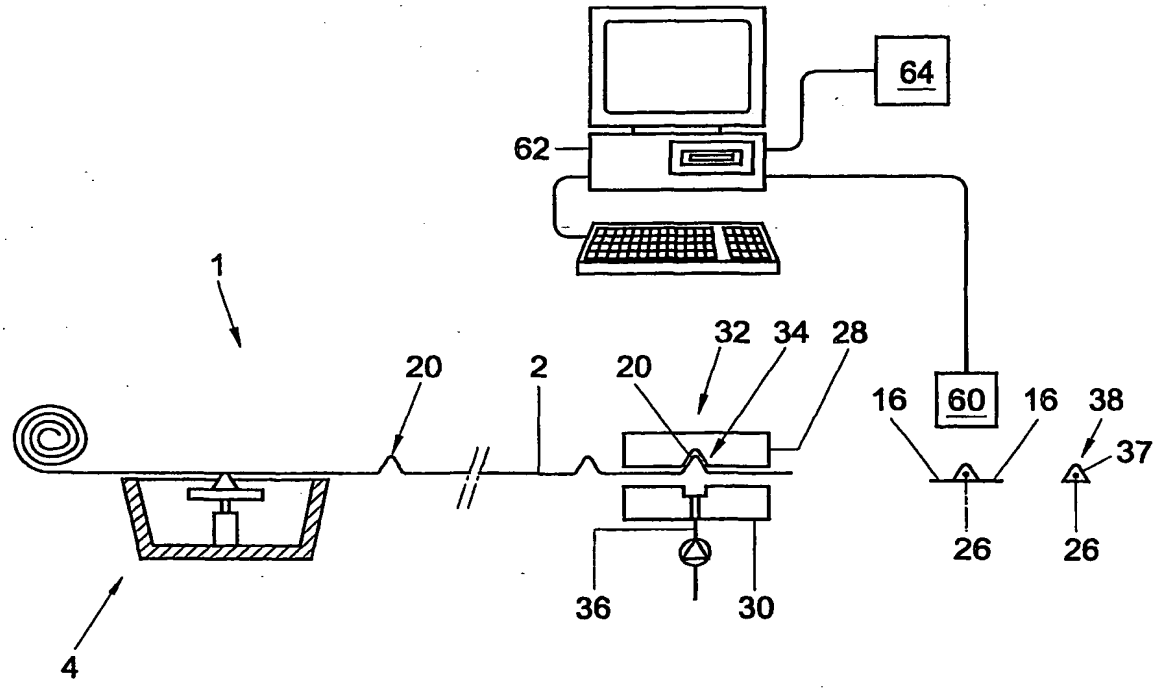
10

Fig. 1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26
26
4

Fig. 2

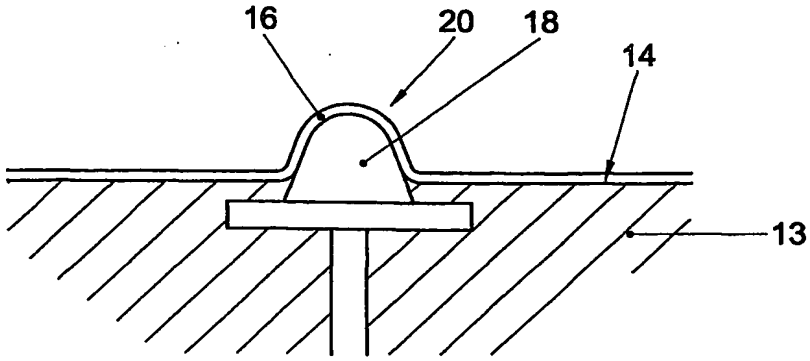


Fig. 2A

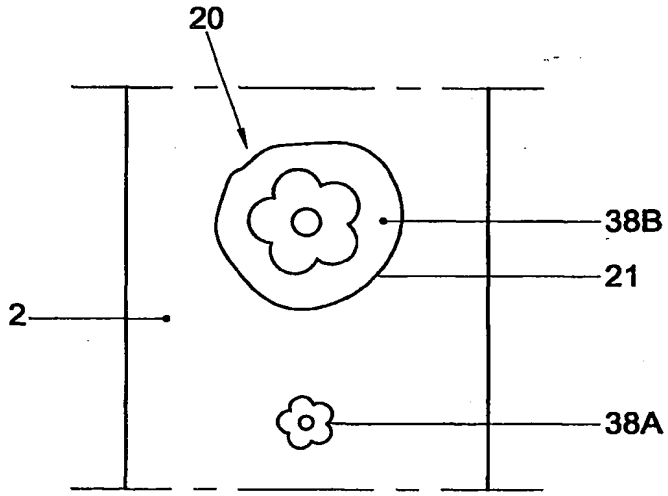


Fig. 3

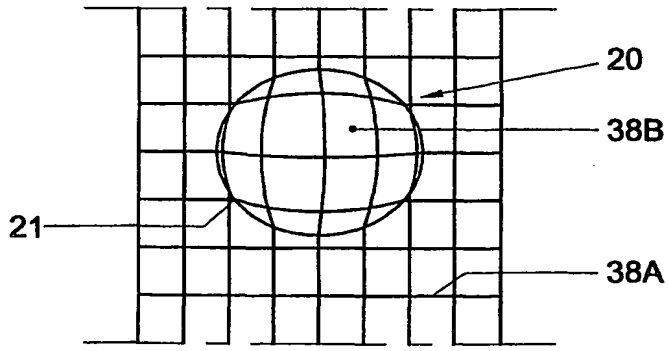


Fig. 4

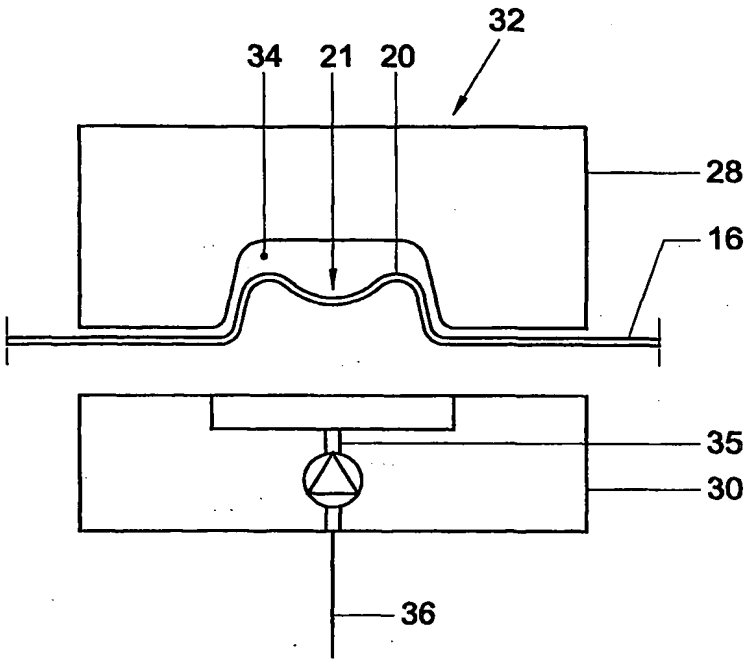


Fig. 5A

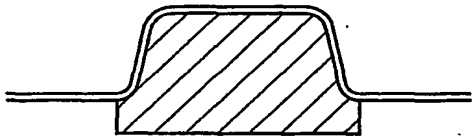


Fig. 5B

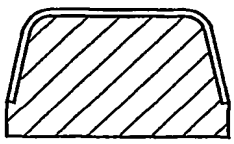
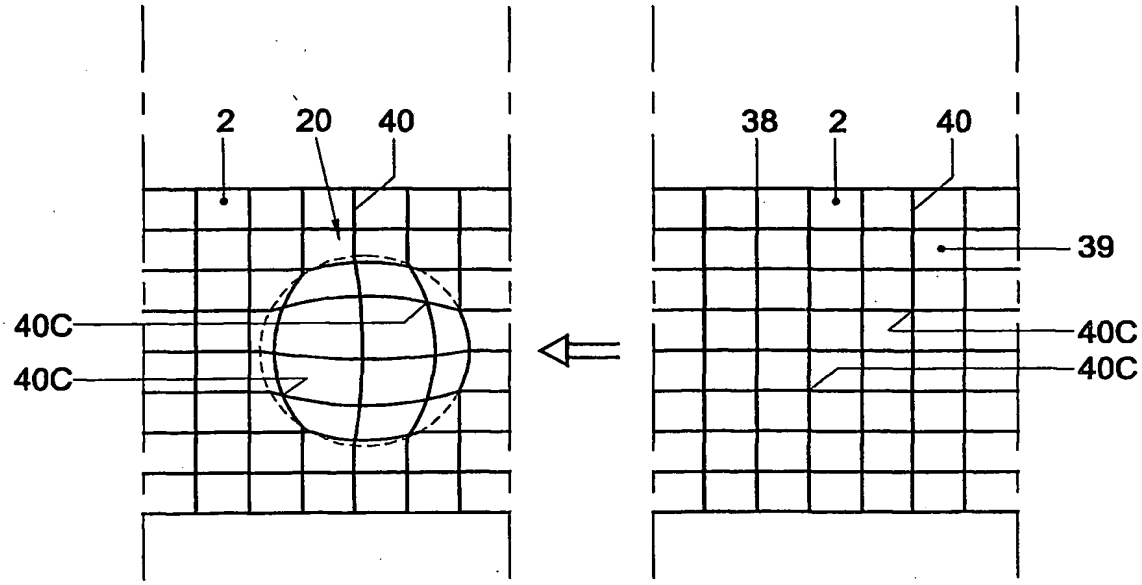


Fig. 5C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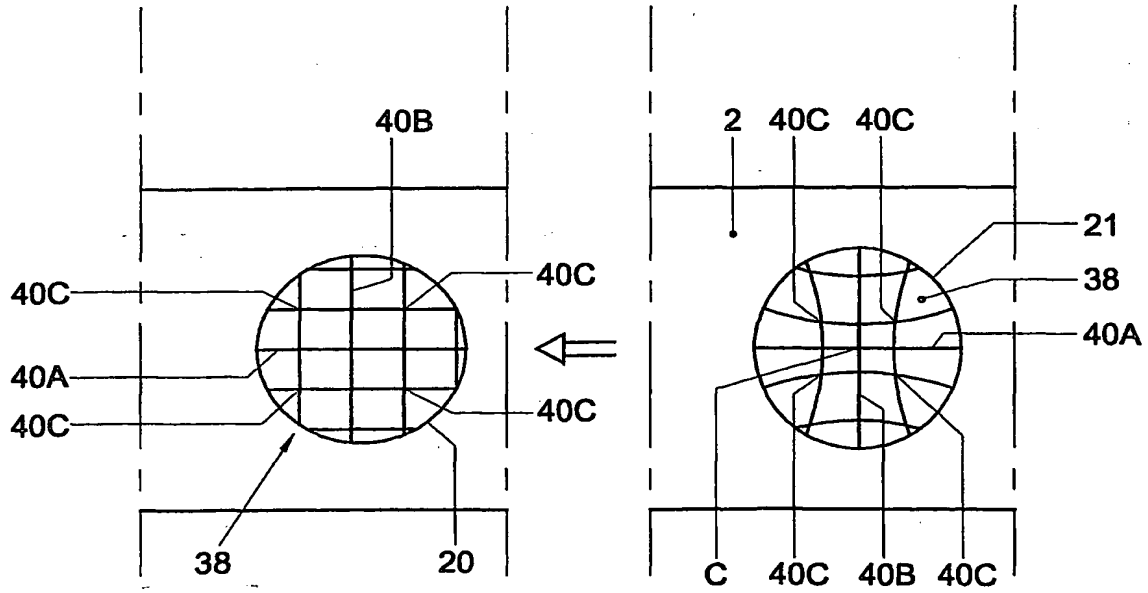
39
40C
40C
40C
40C

Fig. 6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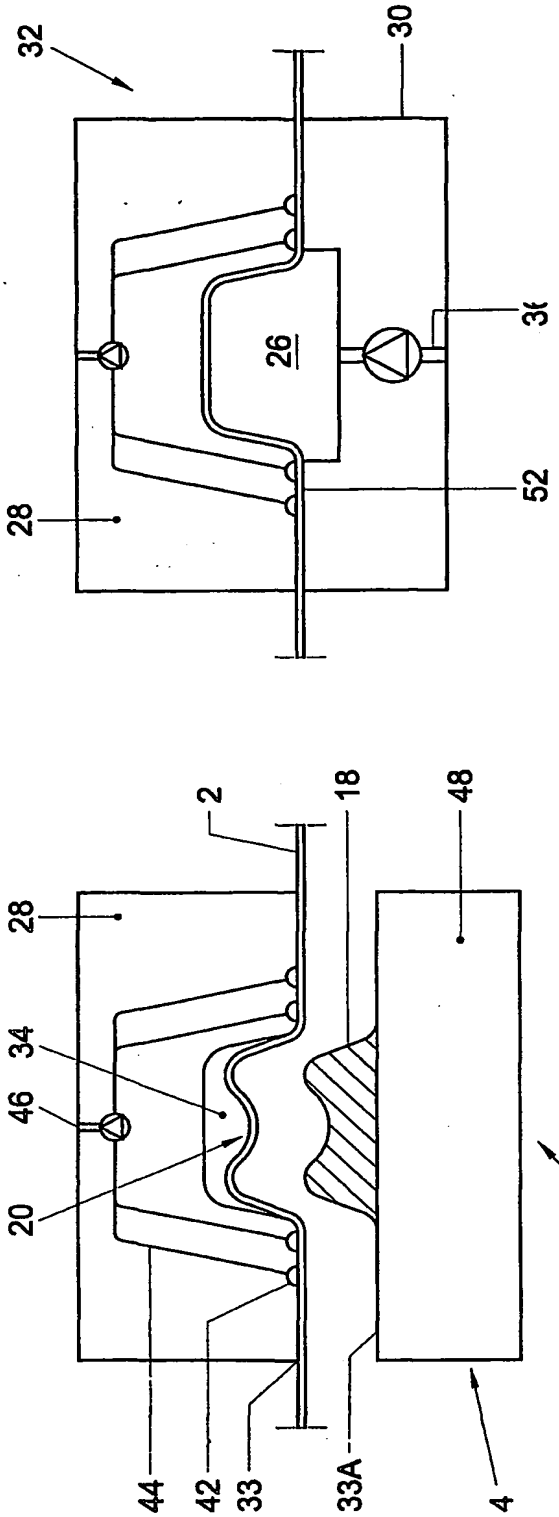
40C

Fig. 7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33A
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Fig. 8

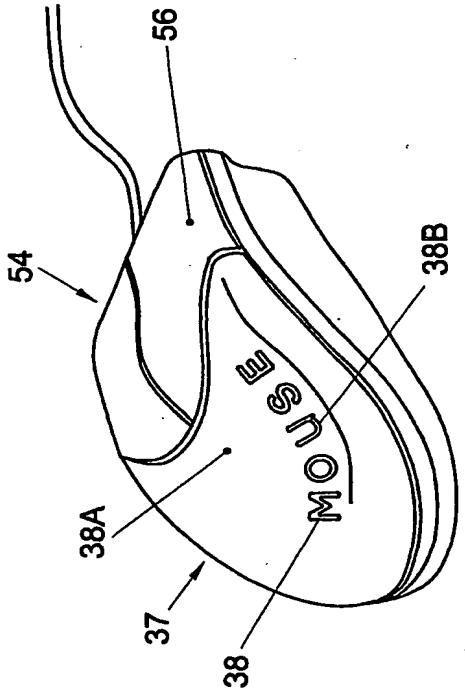
56
54
38B
MOUSE
38A
37
38

Fig. 9

INTERNATIONAL SEARCH REPORT

PCT/NL 01/00877

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B29C63/22 B29C51/08 B29C45/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
26 March 2002	09/04/2002

Name and mailing address of the ISA	Authorized officer
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	GB 2 329 607 A (AEP BORDEN PACKAGING UK LIMITE) 31 March 1999 (1999-03-31) claim 1	13
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